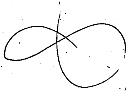
Menlo Park Notebook #223 [N-81-04-06]

This notebook covers the period April-August 1881. Most of the entries are by Francis Jehl. A few entries are by Edison. All of the material relates to electric light and power. There are notes, calculations, and drawings concerning dynamo experiments and tests, including Edison's notes on commutator brushes for the South American dynamo and Jehl's tests of these brushes, based on Edison's instructions. There are also notes by Jehl on changes made in dynamo design as a result of tests conducted at the Edison Machine Works. Other material relates to tests of meters, conductors, steam engines, and motors. The label on the front cover is marked "Francis Jehl" and "Edison Machine Works N.Y." The book contains 280 numbered pages.

Blank pages not filmed: 30-35, 94-95, 230-231, 256-265.



.65

26

1.3

8)9$\frac{1}{2}$ (12 3)65 .20

April 6 1881

Mr Krusie brought some wire (which he called Gold Bronze Wire) to be tested for its conductivity.

Diameter of the wire was .051
Length 10.58 ft
Temperature when tested 78.8 F° = 26 C°

It has been ascertain by good authority that one foot of pure copper wire 1/1000 of an inch in diameter has a resistance of
annealed 9.718
hard drawn 9.940
In this case I take the mean 9.829 ohms therefore pure copper the same diameter and length as sample

would be

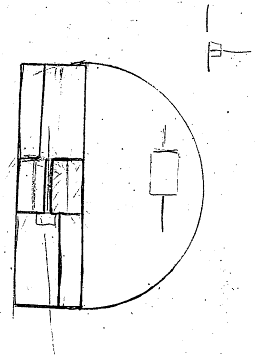
$$\frac{9.829}{51^2} \times 10.58 \times 1.10$$

1.10 is the correction for temperature. Its resistance would be .043979 ohms. The sample I had had a resistance of .10914 ohms. Its conducting therefore was .48%.

Yours
Jabez

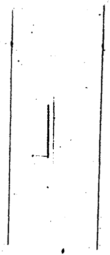
This wire was an alloy of Copper Tin Zinc &c. It was to be used in connecting mains lines together as this could be coiled: which pure Cu will not do.

April 31



april 31 1880

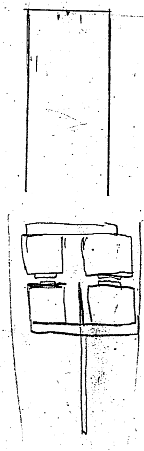
5)95 4
19

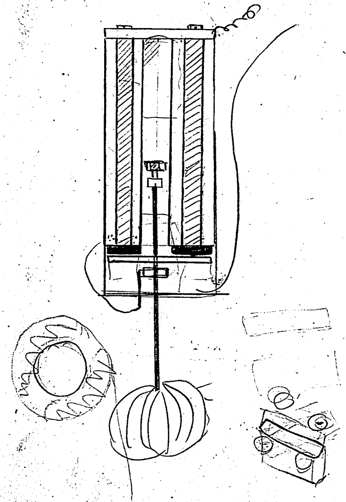


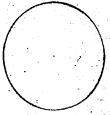
$442\frac{100\ 100}{10000}$

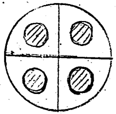
1000)443~~000~~[illegible]

443









Length of Phos Bronze
wire 16 ft 11 meter

16.11

505 .050.5 Diameter

959 : 41 : X : .0187

12°C

1000
41
959

.0187385
959
1686465
936925
1686465

41)17.9702215(.437
164
155
123
320
287.

(50.5 / 50.5)²
2525
2525
2550.25

72
9829.8
16.9
88461
58974
9829
166.1101
1.05
8305505
1661101
174.415605

255025)174.415(.068
1530150
2140000
2040200

.068
15
340
68
1020

.437).0680(.156
437
2430
22
4

16. 11/12 (

11/12)110(9

.003824
13
11472
3824
1.049712

.003824

ohms.

Temp 16° C

46

1000
40
954

954 : 46 :: .0187385 : X
46

946 / 46 = .0187 / X

5
946 X
.0187385
46
3
3
112410
749540
954) .8419710 (.0

46 : 954 :: .0187385

50.5
50.5
2525
2525
255.0125

9.829
66.9

166.11

.003824
16
22944
3824
1.061184

(.014

.0187385
954
749540
936925
1686465
4
46) 17.8765290 (.388
138
4
407
368
396
368
28

.388 Res of wire at 16°C

69 to 166.11
1.06
99666
16611
255025) 176.0766 (1.099
153015
~~23091~~
2306160
225
4
~~1760760~~
~~85175~~
1760766
3
185175

Pure Copper = .0690 ohms
Sample .388

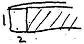
388) .0690 (.178
388
3020
3096

8
46
6
5 6

June 20 1881

Dynamo C. (Paris)
Resistance of Armature as measured .008 ohms.
Res of each separate core of the magnet 2.7 ohms there are six of these core thus making 3 magnets complete

There are 73 commutators



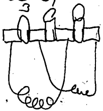
copper bars on armature. 1 on figure is .551 ~~dia~~ long. and 2 is .405 wide. the average length of each bar is about 37 inches

The magnet are wound as follows. There are about 78 turns to one foot. length of magnet including the length taken by the wire is 4.66 ft. Thus making on one layer 78 X 4.66 ft turns. There are 6 layers of wire on each core. The average circumference is 27.5 inches. Diameter of wire is ~~about~~ .134 the regular No 10.

Jehl

June 21 1881

We have large casks in which we put some resistance, and put the machine direct on them. The resistance of these are 2.6 ohms These are arranged as follows; so that



when plug 1 is in there is a res of 2.6 ohms.

when plug 1 & 2 is in a res of 1.3, or when plug 1 & 3 is in a res of 1.3 ohms. when plugs 3 & 2 are in a resistance of ~~0~~.65 ohms.

Jehl

June 29 1881

Test of the resistances of The line consisting of twenty no 10 wire multiple arced and connected to five calorometers consisting of about .65 ohms each. with different battery current.

687 : 313 :: x : .0659274 with 1 cell
683 : 307 :: x : .0659274 " " 5 "
{ Same " " " 10 "
" " 15 "
682 : 318 :: x : .0659274 " 20 "
680 : 320 :: x : .0659274 " 30 "
679 : 321 :: x : .0659274 " 40
678 : 322 :: x : .0659274 " 50
Same " " " 60
" " " 70
" " " 80
" " " 90
" " " 99

.012970 " 1 cell
.012704 " 5 "
" " 10
" " 15
.012639 " 20
.012509 " 30
.012381 " 40

And also up to 100 cell It has the same resistance

F Jehl

$\frac{682}{318}$ $\frac{.0\cancel{65}}{.065}$

$\frac{678}{322}$ $\frac{x}{.065}$ 3 4 4 4

678
.065
3390
4068
322)44.070(.13
322
1187
966

July 11 1881

Machine for Paris A Lamps
Res of Armature .15 ohms
Res of Magnet 63.5 ohms
size of wire on magnets .55 B+Sharp
weight on each core is 92.5 lbs
~~there are ten layers on one~~
Magnet core and eleven
on the other

July 12 1881

Insulation of a piece of fiber

def of one cell 285-290
through 183000 ohms

deflection of all the cell
358 — 361

deflection of one cell 4.5-3

4.5
3
2)7.5
3.7 for 1 cell

358
361
2)719
359 foll all the cell

37) 3590 (97
333
260
259

97

285
290
2)575
287

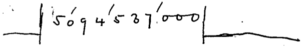
183000
287

1281000
1464000
366000

52521000 Constant for 1 cell
97

367647000 4
4726890 0 0

5,094,537,000 for all cell



Rosfair 350

Insulation of fiber over 1000000 ohm.

Resistance of Cotton insulation of No. 134 is about 13000 ohms per 13 feet

Insulation. Res. of Magnets between wire and iron core

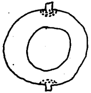
Res. of first 1500
Second 1000
Third 2000

July 14 1881

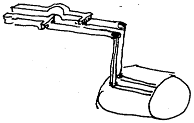
Resistance of the armature of the 'C' dynamo is .0085 ohms.

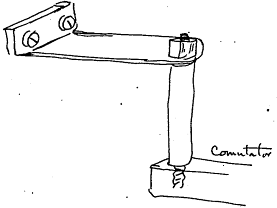
July 15 1881.

After working 55 men days and 60 nights for 8 days and 8 nights we have at last made the change in bars and disk tits which the previous list showed was necessary to make the machine more practical = The narrow tit between which the alternate bars could pass was found to be insufficient and heated the plate thus as shewn by the dotted



line, hence twas necessary to make the tit wide, this would then necessitate passing the bars over the tit instead of between this was done as described in some other book. twas a terrible job. we silver soldered the extra piece on the tit but our big press when done will punch out the plate with tits simutlaneously The inside piece from the plate ~~Kept~~ leading to the commutator. Kept breaking and we connected the bars to the bobbin thus.





We japanned the bars - painted them with Zinc white and Linseed oil, then wound tissue paper then repainted. after assembling put mica between all the bars - put the new anti spark device on, The new foundation being done placed Engine Dynamo on it, 11 am. Engine running nicely. taking indicator diagrams, for friction, now taking with field on 108 Volts across field armature open ⑯ brushes off =

July 15 1881

Dynamo "C"

Deflection on Magnet + armature

Magnets	armature
without any current	on magnets
volts	volts
	14.85 S.350
	15.53. S.351.5
51.97.	108.67 S.350.

Magnet. Volts	Armature vols Rev. 349.5
52.65.	103.27 Rev 350.5
56.02	107.32 Rev 350.5
74.35	115.43 Rev 351.5
81.1	124.83 Rev 351
94.5	135. Rev 357
98.5	141.75 Rev. 362.5
97.87	121.5 Rev.
97.87	122.17 Rev. 339
97.87	137. Rev 378

Magnet	Armature	
94.50	138,	Rev 386
	~~136.22~~	Rev 348.5
91.80	126.22	Rev 346.5
97.20	124.83	Rev 349.
		Rev.
101.25	125.55	Rev 347.5
108.	125.55	343

3(81/2

July 15 1881

This first load was one barrel which had a res. of .65

C dynamo. running 335 rev. for one half an hour. When temp of armature was ascertain it was 130 F° Temp of room 82 F° running for twenty minutes after this with a resistance of .32 ohms its temperature increased to 142° F. with three barrels on a res of .21 ohms the temperature increased to 163 runny for about 20 minutes -

4 at 86°7

100)400(.04
50
2.00

~~1.50~~

1.50

$\frac{1.50}{100} : 100 : \frac{4}{x} : x$

150)4000(2.6
300
1000
900

)1.50 (1.5

100)150 (1.5
50
750

~~1.5~~/100)1.50 (1.5
50
750
2

July 16 1881

Resistance of water at different Temp. F° without ~~[illegible]~~

Six daniells all used in the bridge

Res 150 ohm at 86°7
〃 135 〃 〃 90
〃 115 〃 〃 100
〃 110 〃 〃 110
105 〃 〃 115

This is water clean from the

119 97
110 101
105 108

100)150 (1.5
50
750 2
75

July 16 1881

Experiment on two copper balls, one bare and the ~~its~~ other Japan'ed to measure their capacity for heat. both being put in ~~hot~~ boiling, water and left to ~~cole~~ cool, their temp being taken every five minutes,

Japaned		Bare	
133	— 1	132	— 1.
124	5	124	— 5
113	10	114	— 10
104	15	106	— 15
99	20	101	— 20
		98	— 25

try the experiment with the blower

July 16 1881

Temp 83°F room
Temp of armature 89°F
Experiment to ascertain the heat obtained by the cutting of the armature core through the magnetic lines of the Dynamo magnet.

time	Temp	
9.38 AM	92	Speed 358 running 10 mn
	93	" 358 " 10
		" 356
		355.5
	93.5	Running 30 mn

95 2
95
475 4
855
9025
443
27075
36100
36100

4.6 H.P.

2.16) 399807.5 (153771
21
139
136
98
78 4
200
182 3
187
182
55

33000) 153771 (4.6
132000
217710
198006

25
4|.65
.16

2|2.6
2|1.3
.65

2.6×.16
2.6+.16

3×3
36 6)9

.16
2.6
2.76

.16
2.6
96
32
2.76) .416

3 1

276) 416 (.15
276
1400
1380

5|.65
.13

3 4 3

.13
2.6
78
26

2.6
.13
2.73

.15
.010

2.73) .338 (.12
273
650
546

70) 1.50 (.14
70
300
280

.16

95
95
475
855
9025
44.3

2
4

75,HP

16
4
144

5

16)3998075.0 (2498803
32
79
64
158
144
140
128
127
128
050
48

33000) 2498803 (75.
231000
188803
105000

2

10) 160.

10
150

2

33000) 3163691 (95
297
193
198

15)100 (.7
105

3

15)96 (6.4
90
60
60
0

3

6.4

.107
107
749
107
11449
44.3
34347
45796
45796

16)5074190.70 (3163691
48
27
16
111
96
59
48
110
96
147
144
30

5

8.57 at 75 25 15

30

.008.5

.0085 2

1.065

425

5 1 0

85

.0090525

1.032

.009

1.032

18

9 2 7

.009288

)92

9)150 (16)96

60

54

6

109

109

981

109

11881

44.3

35643

47524

47524

.159

9

33~~000~~

10

159)52632 8.300 (3310~~24~~00

477

330

1

0493

477

162

159

383

318

650

636

140

9)150 (16

60

4

16)100 (16

96

4

5 | .65
.13

212 212

2.6
.13
78
26

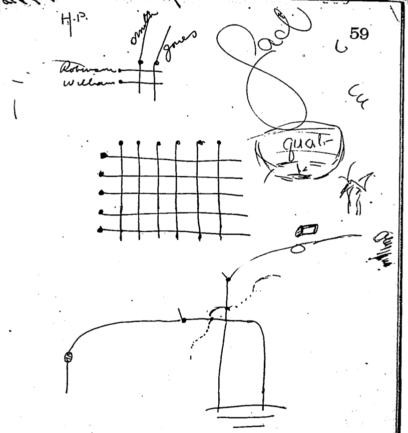
.13 (of 2.6)
.39

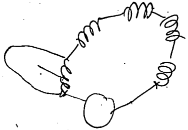
2.6
.13
2.73

273) .338 (.12
273
650
546

12) 52632830 (~~4~~386010
46
46
36
103
96
72
72
83
84
0

33~~00~~) 43.86~~070~~ (132. H.P.
33
1.08
99
96
96
00


H.P.
Smith
Jones
Robinson
Williams
Jack
qual
6
Cu



Temp 79.7° of the bars ~~fe~~ before started.

Temp. of Room 797°

July 16 1881

103.95 V without any magnetic circuit. Speed. 1114
100.57 V with one bar across the poles. bars $\boxed{\frac{3}{4}}^2$ Speed 1112
two bars and no difference in the drop.

100.57 V (1090 speed)
95.83 V. with a bar $\frac{7}{8}$ by $1\frac{7}{8}$ across the poles.
94.5 with two of these bars.
Speed 1160.

Speed 1116. 101.25 volts without any bars. Speed 1087
95.83 volts with one bar on ($\frac{7}{8}$ by $1\frac{7}{8}$) Speed 1107

volts 89.10 Speed 1104.
without any bars 102.60 V
Speed 1090

Volts 102.60.
volts 101. with a crowbar.

Got the machine running up to ~~to~~ its ~~[illegible]~~ speed and then got the volts which was 102.6 Then put a bar of iron across the poles (bar $\frac{7}{8}$ by $1\frac{7}{8}$) and it droped to 95.8 volts and when another bar was put across it went down to 93.1 volts.

July 19 1881

2 Standard cell equal a deflection of 347-347.

deflection at the terminals of the sounder 72-72.

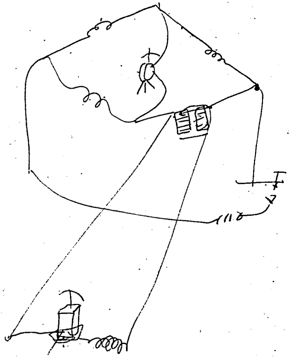
Deflection from Kick is 51-51

deflection from sounder 54.5-54

deflection from Kick 34-34

deflection from sounder 70-70

deflection from Kick 50-50



July 19 1881

deflection on Sounder 70-70
deflection by Kick 50-50
2 Standard cells = deflection
347 - 347.

---

deflection on Sounder 52
" " by Kick 33-33

---

deflection on Sounder 83
" " " by Kick. 60) 3 cell

deflection on Sounder 73
" " " by Kick 41) 2 cell

deflection on Sounder 54
" " " by Kick 32) 1 cell

deflection on Sounder 89
" " " by Kick 70

deflection on Sounder
" " " by Kick.

July 19. 1881
9AE

Test on C dynamo No. 1. machine =

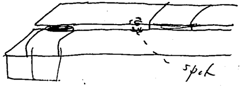
Temp. of air and bars
at commencement of
experiment 80½° F.

Time. 322 full speed, = This test for a few minutes to determine if bearings are all right and she is up to speed, Speed by indicator 355 = no field on - Throttle wide open = We now take friction diagrams - no we had to stop as the iron bands placed around the armature bursted out at the joints and would not hold the copper bars in - We took armature out at 9 pm and ~~started to wind brass~~ wire around it = got this done & armature back in machine at 7 o'clock July 20

Over

July 20 1881

We run armature little while + then put field on just as the field was charging up. Spitting commenced with loud sound across from bar to bar with 1/32 of air space.



Two spits took place both starting from edge of paper or right near the paper - but across air space 1/32 inch The spit was small only threw up knobs about 1/32 dia + roughened edges of bar

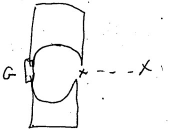
Over

July 20 1881.

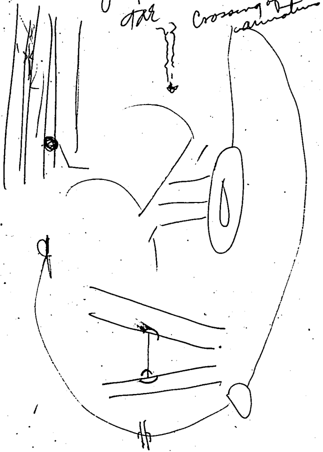
The Commutator brushes were not on

Evidently. This spitting is due to E.M.F. accompanied by a Static effect which first starts a static arc and then the other arc commences - & this is the trouble with all dynamos,

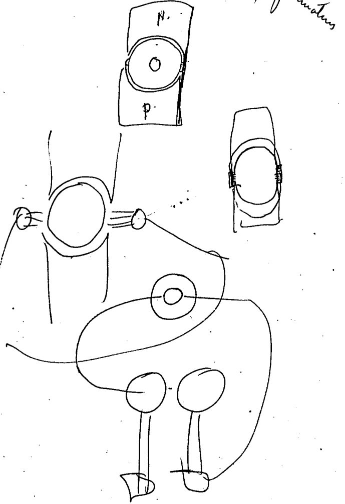
One thing is noticable & that is that the "spit" occurs at the moment the bars pass at X & never at G.

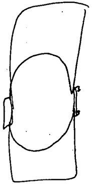


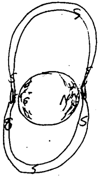
July 20 1881,
TAE
Crossing of armature



July 20 1881
TAE
Crossing of armature



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S
S
N
S
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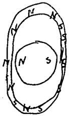
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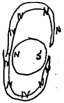
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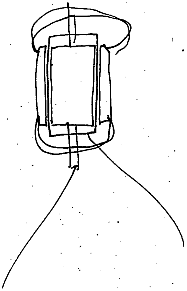
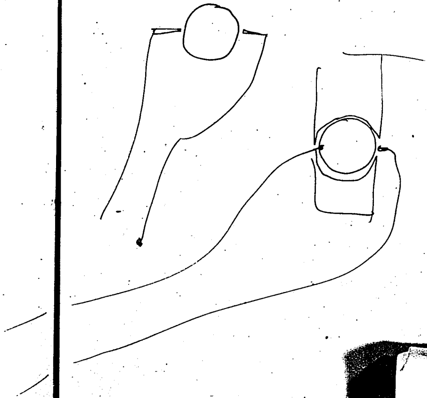
July 20 1881

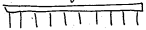
Test the kick between the insulated armature and the field magnet when the field is put on





July 21 1881

We made an arrangment shown in Fig 1



This was held in front of The armature to see if we could collect any electricity, we held it by an insulated handle but, did not get any sign of electricity .. also tried an paper Electrometer without any effect.

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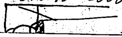
* July 21 1881

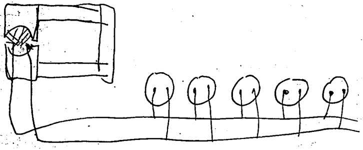
Machine running 333 The field charged by the small machine. We put a sounder with resistance across the line to see if there was any cross: tried it with field and without it. did not find any cross the sounder was steady.

Then we put the cables on the barrels, which were all disconnected.

In front of the poles on the inside was a large metal plate of brass connecting the poles



Now when the armature was connected to the cables which went into the testing room where they were attatched to the resistances coils as show below



The plugs to the resistance coils were disconnected the water being the only conductor across (The resistance of this water is About 8 ohms) Now when the engine was running at 333 Rev. and the magnet was charge from the small machine, when

There appeared a large flash at the armature. This spark only appeared when the cables was on, we having tried it before without any cable and it worked all right.

We then tooka resistance box out of a barrel and put the the machine on, this coil was so arranged so that it have a resistance of 2.6 ohms and when the machine was put on this it went ok. not giving any spark. then we connected the one side of the four barrels and did not get any spark

The other sides were also then connected and we ran about 10 minutes and did not get any spark, then we connected all the other barrels (Gomer in connecting) short circuited the wires and Mr Edison found then that it (the armature) was crossed in three places.)

The Engine was run'd again on ~~seven~~ six barrels the plugs all out. The spark came again.

I then put one resistance in so that it was .65 ohms and immediately the machine sparked.

did not get any spark then the ~~other~~ sides was connected in

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15)85 (57
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ε

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$CR = \varepsilon$

$R = \frac{\varepsilon}{e}$

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÷.00856
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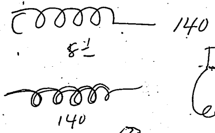

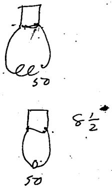

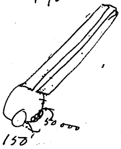

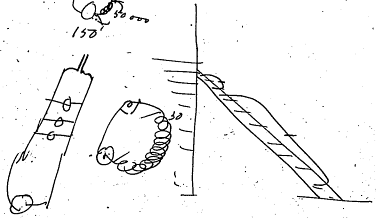

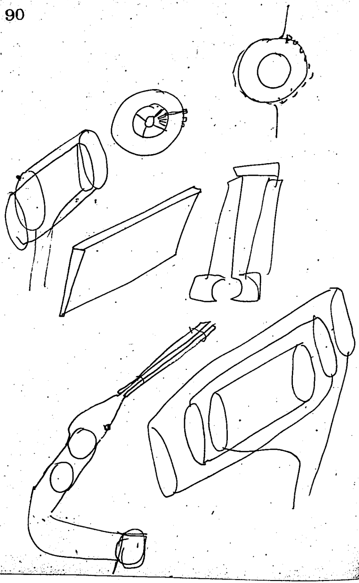

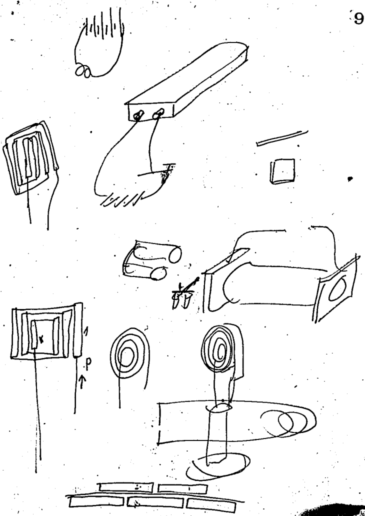
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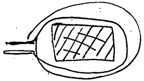

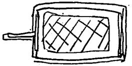

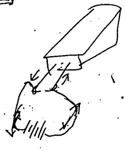

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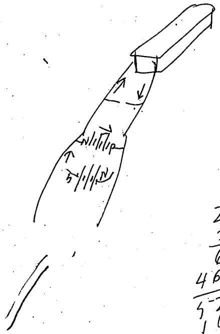

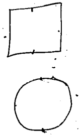

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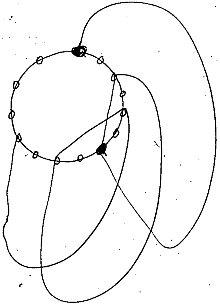

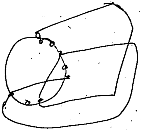

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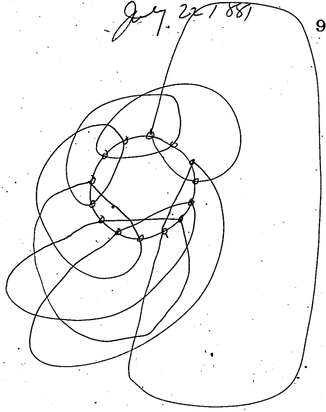

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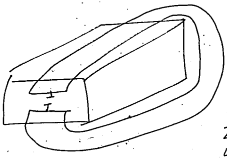

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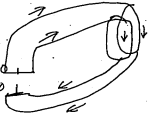

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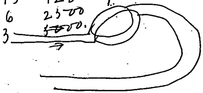

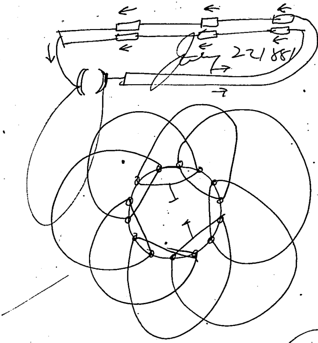

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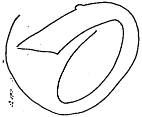

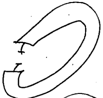

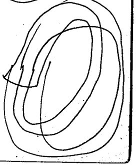

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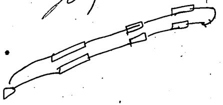

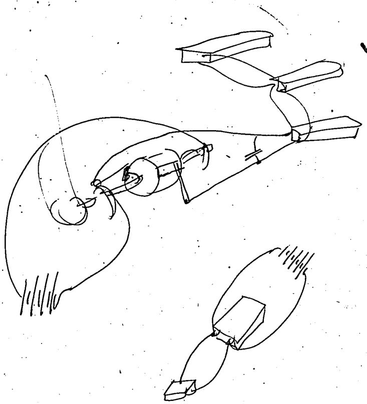

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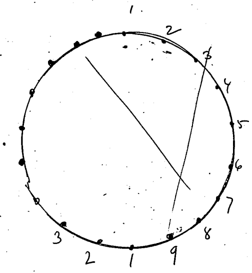
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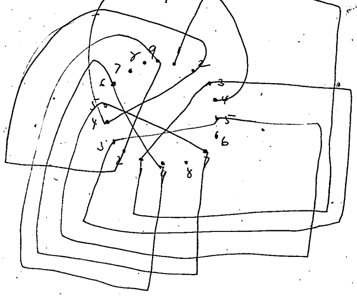
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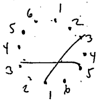

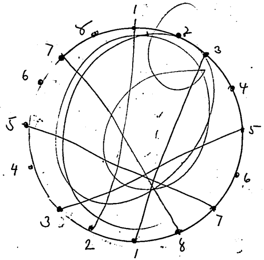

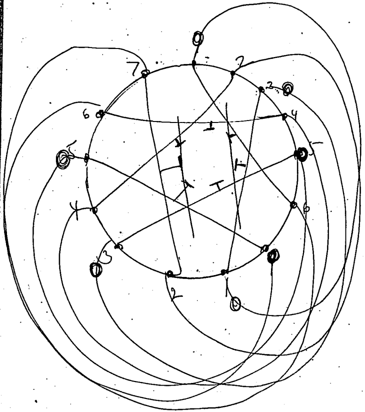

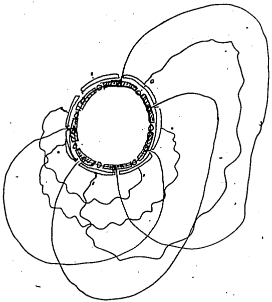

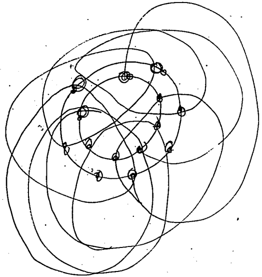

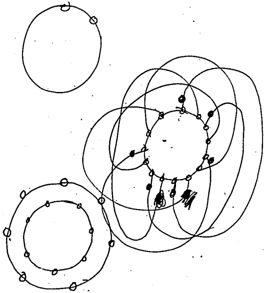

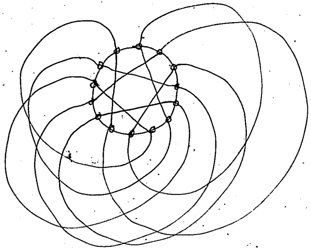

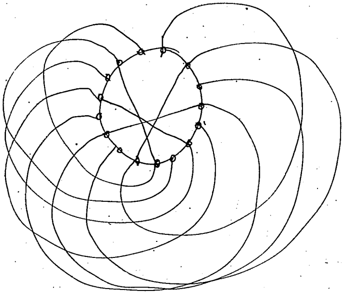

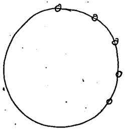

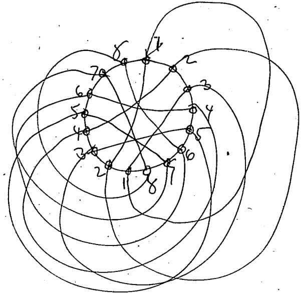

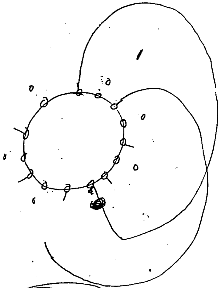
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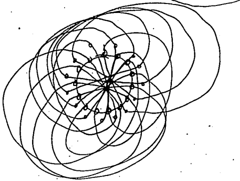

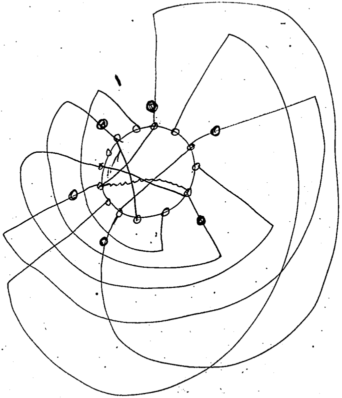

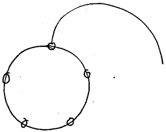

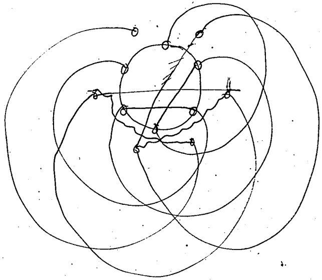

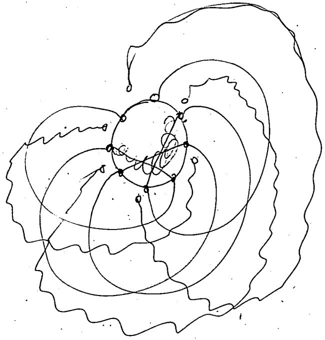

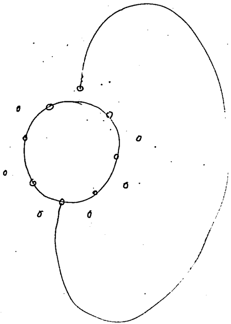

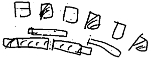

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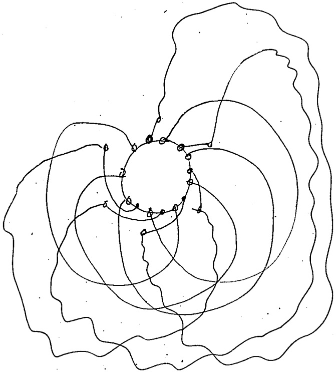

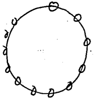

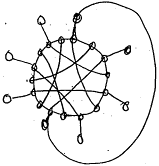

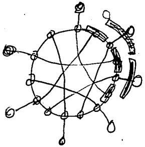

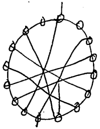

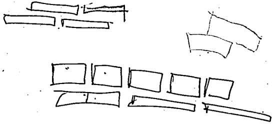

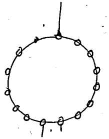

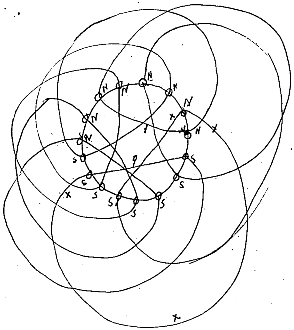
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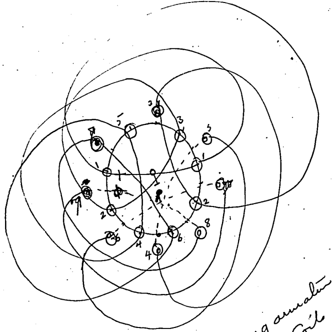

July 25 1881

TAE

OK winding armature with the alternate Coils over the others mks dif EMF small

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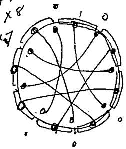

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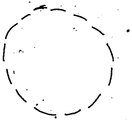

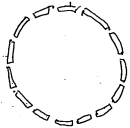

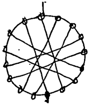

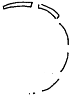

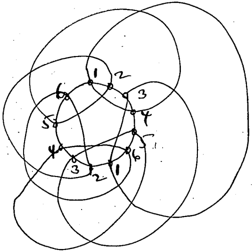

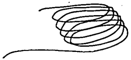

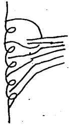

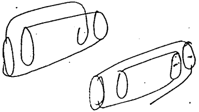

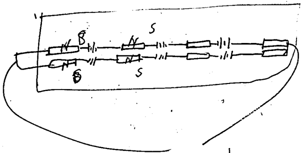
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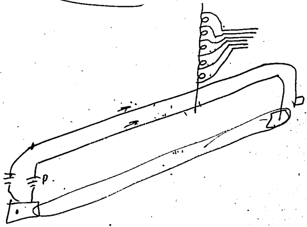
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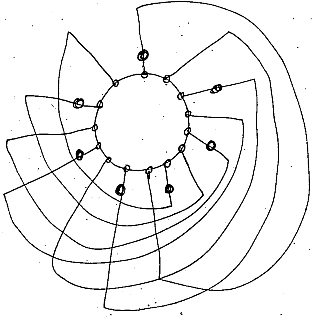
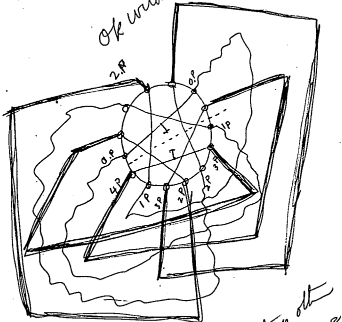


Ok with odd no of Coils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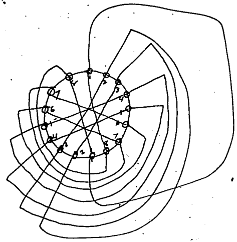
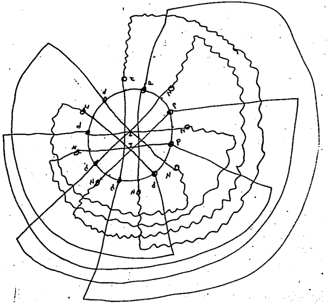
Wounds on top oth

July 25-1881

TAE

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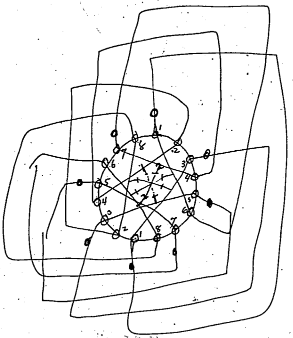

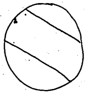

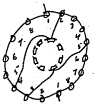

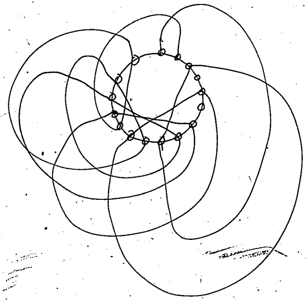

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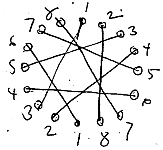
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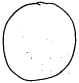

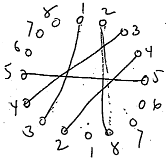
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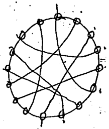

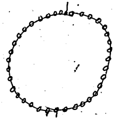

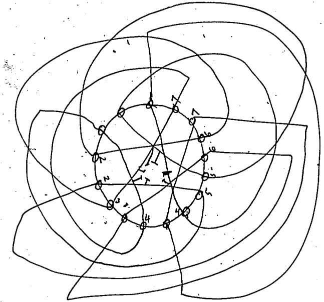
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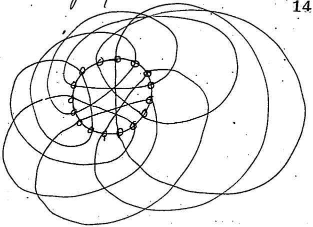
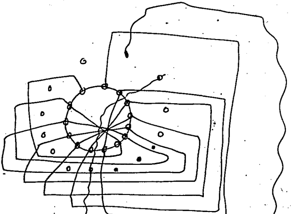
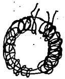
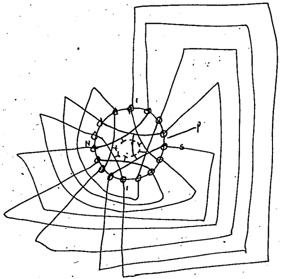
July 22 1881





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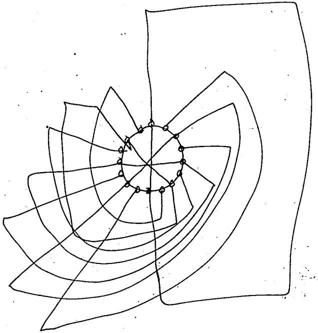
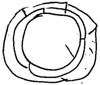
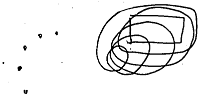
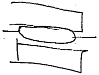
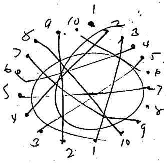






Boston air breaks

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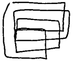

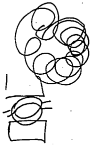

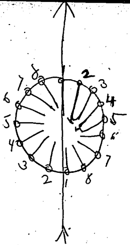
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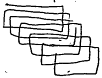

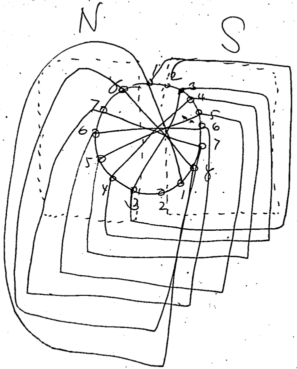
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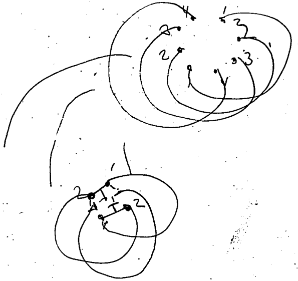
July 22 1881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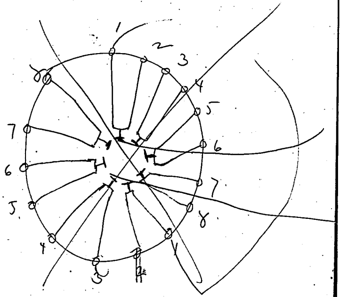
July 23 1881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1

July 26 347 def on one cell through 10000 ohms.

deflection with x res = 21 - 21

deflection through 10000 ohms, 347 - ~~345~~ 351

deflection with x res 15 cell - 321 - 324

July 26

347
351
2)698
349 maximum def.
10000 ohms

21)3490000(166190. ohms
21
139
126
130
126
40
21
190
189
10

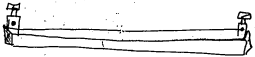
3490000
15
17450000
3490000
322)5235000(16257
322
2015
1932
830
644
1860
1610
2500
2254
2460

24
21
2)45
22

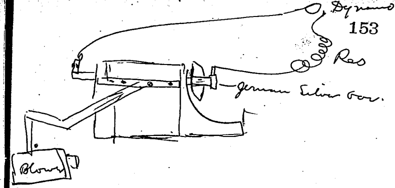
6190
2077
3013

July 27 1881 7/16

Went to Bergmann and had a piece of German Silver strip .0065 of an inch thick, and about 28/16 wide. had this piece which was about 3 ft long made into a square bar th like This



I then connected This with the small dynamo machine with 2.6 ohms in circuit. And it heated it up to 195°F. I then had the experiment tried as shown in the fig on the next page



~~Temp~~	~~time~~
~~beginning 195°F~~	~~First minute~~

Temp.

beginning	~~1 Minute~~			
205	0	205	143°	~~1~~
	10 Second	190°	146	15"
	20 "	175°	152	30"
	1 Minute	155	156	45"
	2 Minuts	144	162	1'
	3 "	138	168	1.15"
	4 "	" "	171	1.30"
			174	1.45"
			178	2'

Temp °F.	Line
181	2.15"
182	2'.30"
185	2'.45"
187	3'.
189	3'.15"
190	3'.30"
191	3'.45"
194	4'.
195	4'.15"
196	4'.30"
198	4'.45"
199	5'.
200	5'.15"
201	5'.30"
202	5'.45"
203	6'.

~~Temp~~ °F	Line
203°	6'.15"
204	6'.30"
204	6'.45"
205	7'.
206	7'.15"
206	7'.30"
207	7'.45"
208	8'
209	8'.15"
209	8'.30"
210	8'.45"
210	9'
211	9'.15"
211	9'.30"
212	9'.45"

Temp	Time
212 F.	10"
212	10'.15"
212	10'.30"
212	10'.45"
213	11'
213	11'.15"
213	11'.30"
213	11'.45
214	12"
214	12'.15"
214	12'.30
214	12.45
215	13
215	13'.15"
215	13'.30"
215	13'.45"
216	14
216	14.15

Temp	Time
216	14.30
216	14.45
216	15.
217	15, 15
217	15, 30
217	15, 45
217	16.
217	16.15
217	16.30"
218	16.45"
218	17.

~~Temp F°~~ →

~~Temp F°~~		
216	10.	here we put the blast on again and took the temp every 10 seconds.
211.	20	
205	30	
201	40	
196	50	
191	60 /	
187	10	
184	20	
181	30.	

Temp F°	Time Seconds	
179	40	
177	50	
174	60	2
170	10	
169	20	
167	30	
166	40	
165	50	
164	60	3
164	10	
163	20	
162	30	
161	40	
160	50	
159	60	4
158	10	
158	20	
157	30	
156	40	
155	50	
155	60	5

Temp	Time	
155	10 seconds	
154	20	
153	30	
151	40	
151	50	
151	60	6
151	10	
151	20	
150	30	
150	40	
150	50	
150	60	7
149	10	
149	20	
149	30	
148	40	
148	50	
148	60	8
148	10	
147	20	
147	30	
147	40	
147	50	
146	60	9

Temp F°	Time in seconds	
146	10	
146	20	
146	30	
146	40	
146	50	
146	60	10

Then I took This bar of German Silver and covered it with 8 Thickness of the parchment paper was used in present experimenting on. In this experiment the blast only struck on one side of the bar.

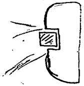
~~Time in Seconds Temp in F°~~

Temp. begining 210

Time	Temp	Time	Temp
10	207	10	159
20	203	20	158
30	199	30	157
40	195	40	155
50	190	50	154
60 — 1'	186	60 — 4'	154
10	183	10	153
20	179	20	152
30	176	30	152
40	174	40	151
50	172	50	150
60 — 2'	170	60 — 5	150
10	168	10	150
20	166	20	149
30	164	30	148
40	163	40	148
50	161	50	148
60 — 3	160	60 — 6	147

Time	Temp
10	147
20	147
30	146
40	146
50	146
60 — 7'	146
10	146
20	145
30	145
40	145
50	145
60 — 8'	144
10	144
20	144
30	144
40	144
50	144
60 — 9	144
10	144
20	144
30	144
40	144
50	144
60 — 10	140

Then we tried the bars so that a circulation of air could be passed around it. There was an air space of about $1/32$ of an inch.



Temp begining 200

Time in Seconds

Time.		Temp
10		19.1
20		184
30.		172
40		162
50		152
60		147
10	1	142
20		137
30		132
40		128
50		126
60	2	123
10		118
20		108
30		
40		108

Time		Temp
50		104
60	3	102
10		100
20		
30		
40		
50		
60	4	
10		
20		
30		
40		
50		
60	5	

Time		Temp 205
10		197
20		187
30		179
40		169
50		160
60	6	154
10		147
20		143
30		138
40		136
50		132
60	7	129
10		125
20		124
30		122
40		121
50		120
60	8	118
10		117
20		116
30		
40		
50		
60	9	
10		
20		
30		
40		
50		
60	10	109

July 29 1881

Quiall Motor test

Resistance of the magnet = 3 55 ohms
Armature Res = 4.5 ohms

4|321
80:

80 times

~~10000~~
~~60~~
~~600000~~
~~80~~
~~7|48,000,000~~

10000
60
600000
80
7|48,000,000
60 6.8 0000

7/8

2|120
60
59/61

322
321
2|643
4|321.5
8

12)70
60
10
6
5.8

1

Aug 1 1881

Test of the insulation of Mr Kruesi. Tubes

~~Def from all the cell 303-305~~
~~One cell~~

Deflection from all cells. 322 — 321
" " one " 3 — 5

Def one cell through 10 000 ohms. 59—61

Deflection through the tube with all the cells - 5 - 9

1 5—9
2 4—8
3 4—8
4 3—7
5 3—7
6 3—7

339 through 10000 ohms
1 cell . 342

1
10000
340

400000 3
30000

3400000
80
70 | 272000000~~0~~

40

70
35
2 | 105
50

5~~00~~) 272000000
544000 22

5) 272000000
544 0000

5.440 000

1 cell = 356 — 355 difference
2 cells = 7—8
1 cell = 3—4

1 cell through 183000 ohms
= 243 — 230

4

One ell Through 183000
230 — 229

---

20 ell 9,15
9
2)24
12

183000
230

5490000
3660000

42090000
20

12) 841,800000 (70,150,000
84
18
12
60
60
0

Aug 2 1881

time 2 AM.
Measured the Paris Machine. its resistance was ..0092 ohms.

The bars of the machine as now insulated consists of first, in the bars being Japanned ~~ff~~ five times and then wound with two layers of the special parchment paper and this being japanned also.

The machine was started at about 6.30 am. Aug 2 1881.)
She ran 30 4 Revolutions and gave 92 volts

with 1 barrells or .65 ohm in circuit which is equal to about 200 lamps with the present resistance of 125 ohms.
Then with 3 22 Revolutions we got 96 volts, still .65 ohm in circuit.

335 Revolution 99 volts
342 Revolution 101 volts
346 Revolutions 103 volts
350 Revolutions 105 volts
350 Revolutions 97 volts this time 2 barrels which is equal to about 375 lamps.

380 Revolutions 92 volts with 3 barrels which is equal to about 625 lamps

and with 4 barrils the electromotive went down to 87 volts, the 4 barrels equal to about 800 lamps.

All these trials so far were ~~to~~ made without that extra magnet

---

With that extra magnet added the electromotive went up to 95 volts with 338 Revolutions. With this load on of the four barrels it ran for 25 minutes, then we stoped to put another bar around the armature

---

Aug 2 1881

Res of Small motor Mag. 355 ohms
Armature Res 4.7 ohms

Revolutions 1280

with no current on the magnets Residual magnetism deflect from armature 98 – 97
Standard cell 20 def = 298 – 299

armature deflection 146 – 138 10.15
standard cells 298 – 299 ~~[illegible]~~
Magnet 94 – 101 6.9 volts
Standard cells 298 – 299

Magnet = 199 – 192 14 volts
Standard cell = 298 – 299
armature = 190 – 188 13.5
Standard cell = 298 – 299

Revolutions 1190

Armature 243 – 245 17.5 volts
Standard cells 298 – 299
Magnet 262 – 255 18.5 volts
Standard cell 298 – 299

Revolutions 1160

Magnet 350 – 345 23.7 V
Standard cell 298 – 299
Armature 337 – 338 24.1 V
Standard cells 298 – 299

Revolutions 1268

Armature 333. 330 33.6 V
Standard cells 212 – 212
Magnets 340 – 334 34.5"
Standard cells 212 – 212

Revolutions 1290

Magnets 286 – 289 38.8 V ~~40~~
Standard cells 154 – 153
Armature 250 – 258 34.9
Standard cell 154 – 153

Revolutions 1298

Armature 305 – 305 43.2 volts

Standard cells 154 – 153
Magnets 309 – 315 43.8 volts
Standard 154 – 153

Revolutions 1260

Magnets 270 – 270 54.5 volts
Standard cells 109 – 108
Armature 236 – 236 45.8 V
Standard cells 109 – 108

Revolutions 1281

Armature 272 – 276 54.6 volts
Standard cells 109 – 108
Magnets 347 – 339 66.9 V
Standard cells 109 – 108

Revolutions 1279

Magnets 274 – 275 54.4"
Standard cells 109 – 108
Armature 210 – 212 41.9"
Standard cells 109 – 108

Revolutions 1219

Armature 205 — 204 40.1
Standard cells 109-108 82.4
Magnets 316 — 313
Standard cells 109 — 108

~~Revolutions~~ 1205
Magnets 224 — 224 103.3
Standard cells 49 — 45 60.4V
Armature 183 — 183
Standard cells 49 — 45

~~Revolations~~
~~Armature~~
~~Standard cells~~
~~Magnets~~
~~Standard cells~~

49
45
2)94
47)132 (2.8
94
380
6

21.6
2.8
1728
432
60.48

2

47)225 (~~2~~
141
2

5 47)225 (4.8
188
370
376

21.6
4.8
~~1728~~
~~864~~
143.68 volts

21.6
4.8
1728
864
103.68 volts.

Aug. 2 1881

Test of the "C" Dynamo

armature Res .0092 magnets 19.3 oh

Started 11.45 P.M.

Residual magnetism
deflection on armature.

Rev. 343
battery 32 32
Machine 6—6 4 volts
Diagram no 1

Rev 350
armature 136—135 9.28v
Standard 314—311
Magnet 35—35 2.3v
Standard 311—314
diag no 2

Magnet 81—81 5.6v
Standard 311—314 no 3 diag
armature 341—346 23.7v
Standard 311—344
Rev 348

Arm
Mag
Rev

Arm 244—239 47.5v
Standard 108—109
Mag 59—57 11.4v
Standard 108—109
Rev 350
Diag no 4

3 lamp on to
put the lamps off

Diag no 5
Mag 81—77 15.7v
Stand 108—109
Arm 296—291 58.3v
Stand 108—109
Rev. 348

Diag no 6
Arm 320—328 64.8v
Stand 108—109
Mag 92—93 18.3v
Stand 108—109
Rev 352

Diag no 7

Mag 103 – 101 20.3V
Stand 108 – 109
Arm 340 – 335 66.9V
Stand 108 – 109
Rev 346

Diag No 8

arm 206 – 209 71.2
Stand 62 – 63
Mag 65 – 65 21.6V
Stand 62 – 62
Rev 350

No 9

Mag 72 – 73 23.7V
Stand 62 – 63
Arm 216 – 219 75.6V
Stand 62 – 63
Rev 350

No 10

arm 225 229 77.7V
Stand 62 – 63
Mag 81 – 79 28.V
Stand 62 – 63
Rev. 350

No 11

Mag 88 – 85 30.2V
Stand 62 – 63
Arm 241 – 236 82.V
Stand 62 – 63
Rev. 349

No 12

arm 250 – 255 86.4V
Stand 62 – 63
Mag 96 – 100 – 32.4V
Stand 62 – 63
Rev 351

No 13

43.2V

Mag ~~[illegible]~~ 121–124
Stand ~~[illegible]~~ 62–63
Arm 270–275 95.V
Stand 62–63
Rev 351 –

No 14

Mag 156–160 54.V
Standard 62–63
Armature 290–284 99.36V
Stand 62–63
Rev 350

No 15

Arm 301–292 101.5V
Stand 62–63
Mag 195–191 66.9V
Stand 62–63
Rev 351

No 16

Mag 210–214 73.4V
Stand 62–63
Arm 296–304 103.6V
Stand 62–63
Rev 349

No 17

Arm 310–301 105.8V
Stand 62–63
Mag 240–242 84.2V
Stand 62–63
Rev 350

No 18

Mag 264–258 90.72V
Stand 62–63
Arm 315–306 108.V
Stand 62–63
Rev 349

No 19

Arm 310 – 319 108.5V
Stand 62 – 63
Mag 289 – 297 101.5V
Stand 62 – 63
Rev 351

No 20

Mag 290 – 283 99.3V
Stand 62 – 63
Arm ~~62 – 6~~ 318 – 307
Stand 62 – 63
Rev ~~349~~ 350

No 21

Arm 314 – 321 110.1V
Stand 62 – 63
Mag 333 – 336
Stand 62 – 63 116.6V
Rev 348
Stop 2.10 am Aug 3 1881

10
19
29

62)314(5
31
4

21.63
10.80

with extra magnets on
the deflection was 214 - 214
Standard batteries 46 - 49

Started at

This is with four barrels
Magnet 207 = 207
St. batteries 46 — 49
Armature. 87 — 85
St batteries 46 — 49
Rev ~~35~~ 120 1 minute

---

magnet
standard Constant as above
armature 70 — 67
Standard 46 — 49
Rev 10,4

armature 68 — 70
Standard 46 — 49
Rev 96
30.2 ✓

---

armatures 56 — 53
Standard 46 — 49
Rev 88
23.7 ✓

---

armatures 86 — 84
Standard 46 — 49
Rev ~~12~~ 136
38.0 ✓

---

armature 104 — 100
Standard 46 — 49
Rev 140
45.3 ✓

Armature 101 – 104
Standard 46 – 49 47.1
Rev. 146

Armature 105 – 102 47.5
Standard 46 – 49
Rev 148

Armature 102 – 105 47.5
Standard 46 – 49.
Rev 150

Armature 134 – 131 605
Standard 46 – 49
Rev. 200

Armature 120 – 121
Standard 46 – 49 54.5
Rev 196

~~Armature 136 – 133~~
~~Standard 46 – 49~~
~~Rev 198~~
I believe entire line is wrong

Armature 131 – 134 60.4
Standard 46 – 49
Rev 200

Armature 134 – 131 60.45
Standard 46 – 49
Rev 200

Armature 150 – 147 66.95
Standard 46 – 49
Rev 216

Armature 151 – 154 695
Standard 46 – 49
Rev 224

Armature 155-152
Standard 46-49
Rev 222
6.9V

Armature 159-162
Standard 46-49
Rev 240
13.4V

Armature 159-162
Standard 46-49
Rev 232
13.4V

Armature 159-162
Standard 46-49
Rev 232
13.4V

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armature 165-162
Standard 46-49
Rev 242
15V

Armature 162-165
Standard 46-49
Rev 243
15V

---

armature 166-165
Standard 46-49
Rev 243
15.6V

Armature 175-178
Standard 46-49
Rev 265
19.9V

---

armature 178-175
Standard 46-49
Rev 26.6
82V

---

armature 176-179
Standard 46-49
Rev 268
82V

Armature 180-189
Standard 46-49
Rev 268
86.4

Armature 141--194
Standard 46-49 88.5V
Rev 298

Armature 196—193
Standard 46—49 88.8V
Rev 301

Armature 205-202
Standard 46-49
Rev 322 92.8V

Armature 204-207
Standard 46-49 95V
Rev 320

Armature 208-206
Standard 46-49
Rev 323 95V

Armature 210-213
Standard 46-49 97V
Rev

Armature 214-211
Standard 46-49 97.5V
Rev 330

Armatures 214-211
Standard 46-49 97 Volts
Rev 327

Armature 215-212
Standard 46-49
Rev 330

Armature
Standard
Rev

Armature
Standard
Rev

JJ!

Aug 4 1881

Started at 2.26 am.
Load four barrels.
Res ~~338~~ 334 95 volts

2.6.

$\frac{2.6}{x} : 4 : 13291 : 28134$

$900 \overline{)12500} (138$
9
3500
2700
8000
7200

283
2.6
1698
566
$329 \overline{)735.8} (2.23$
658
778
658
1200

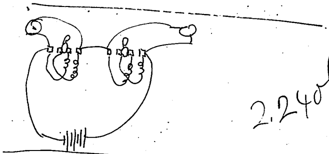
1

$2 \overline{)2.23}$
$2 \overline{)1.11}$
.55

$4 \overline{).55}$
.1375

30

Aug 4, 1881 Test of the Res of a resistance in water and out of it with a dyamo current



2.24 ohm

Temp of water 97°7
Temp of room 83

Deflection on outside coil ~~338~~ 330
.. .. inside .. 280
277

~~deflection cask~~
~~.. .. outside~~

Cask			Outside		
282	284	286	329	331	325
283	284	275	329	328	314
283	281	266	329	326	305
284	281	261	329	326	300
284	281		329	325	301
	285			311	
	282				

66.5
.145
13.0

Sad

---

when Q is all on the out side 7.
Time

Deflection
Outside 284

---

inside
def.

Inside	outside
~~7~~	310
269	
269	312
	314
272	314
269	309

Meter Test Aug 5 1880

screw plate Monthley weight	without screw Weight
78103½	67695
76456.45	69368.5

a gain of 1673.5 mg of copper
15 lamps burning 33 hrs
1 lamp burning 33 hrs will deposit
111.5 mg of ~~cop~~ copper & for 1 hr 1 lamp
will deposit 3.380 mg.

So

70929	71312
70902.3	71376.6

yearly cell for 1 lamp burning
33 hr will gain 4.30 mg
and for 1 hour it will deposit
.13 mg

Aug 5 1881 Paris test.

~~Whil~~ ~~without any current on the magnet deflection on~~

~~arm 266 - 263~~
~~St. B. 297. 295.~~
~~dia 1~~
~~Rev 353~~

~~arm 293 - 295~~
~~S.B. 297 - 295~~
~~Mag 37 - 39~~
~~S.B. 297 - 295~~
~~Rev~~

~~without an c on mag~~
~~arm 212 - 2[illegible]1~~
~~S.B. 297 - 295~~
~~Slain lbs 124~~
~~Rev~~

mag
S.B.

with C on mag.

arm 206 - 202
SB 297 - 295
Rev 349
dia 1
mag

Mag 38 - 40
S.B 297 - 295
arm 243 - 246
S.B 297 - 295
Rev 350
dia 2

---

mag 80 - 77
S.B 297 - 295
arm 334 - 331
S.B 297 - 295
Rev 343
dia 3

---

4 lamps taken off here

mag 76 - 73
S.B 195 - 197
arm 276 - 283
S.B 195 - 197
Rev 350
dia 4

Mag 97-99
S.B 195-197
arm 225-227
S.B. 121-124
Rev 352
dia 5

Mag 74-77
S.B 121-124
arm 246-266
S.B 121-124
Rev 350
dia 6

Mag 91-88
S.B 121-124
arm 301-300
S.B 121-124
Rev ~~7~~ 349
dia 7

Mag 100 10.2
S.B 121-124
arm 321-325
S B 121-124
Rev 349
dia 8

Mag 116-114
S.B 121-124
arm 276-275
S B 94-92
Rev 350
dia 9

arm 285-287.
S.B. 94-92
Mag 99-98
S.B. 94-92
Rev 351
dia 10

Mag 108-109
S.B 94-96
arm 309-309
S.B 94-92
Rev 351
dia 11

~~Mag~~
~~S.B~~
~~arm~~
~~S.B~~
~~Rev~~
~~dia 12~~

Mag 115-110
S.B. 94-92
am 320-321
S.B. 94-92
Rev 350
dia 12

Mag 130-132
S.B. 94-92
am ~~130~~ 345-349
S.B. 94-92
Rev 348
dia 13

Mag 95-96
S.B 63-62
Am 250-245
S.B 63-62
Rev 350
dia 14

Mag 104-96
S.B 63-62
am 251-249
S.B 63-62
Rev 349
dia 15

Mag 113-122
S.B 63-62
Am 268-275
S.B 63-62
Rev 348
dia 16

Mag 136-126
S.B 63-62
am 281-282
S.B 63-63
Rev 351
dia 17

Mag 140-148
S.B 63-62
Am 292-294
S.B 63-62
Rev 350
dia 18

Mag 183-176
S.B 63-62
Aur 318-316
S.B. 63-62
Rev 350
dia 19

Mag 196-203
S.B 63-62
Aur 324-324
SB 63-62
Rev 351
dia 20

Mag 224, 217
SB 63-62
Aur 253-248
SB. 51-44
Rev 349
dia 21

Mag 186 180
SB 51-44
Aur 259 254
SB 51-44
Rev 350
dia 22

Mag 200-215
SB 51-44
Aur 262-265
SB 51-44
Rev 351
dia 23

Aug. 6 1881

Experiment to determine the amount of foot lbs require to heat a given surface to a given temperature.

J. Q.

Amount of surface on the strip which was of german Silver. 18 3/8" long 2" wide

18 3/8 = 18.37 this × by 2 = A
which is 36.74 sq inches
This × by 2 = 73.48 sq inch of surface on the whole strip.

1 Experiment.

Temp of Room 85°F
E.M.F. at the two ends of the strip = .197457 volts.
Temp of the strip when raised to this temp 103°F.
Res. of strip .008 ohm at. at about 85°F.

2 Sd Experiment

EMF on the two ends of the strip .175877 volts
Res of Strip .008 ohms
Temp of Room 86°F
Temp of Strip 99°F

3d Experiment.

E.M.F. between the ends is .130559 volts.
Res of Strip .008 ohms
Temp of Room 86°F.
Temp of Strip 94°F.

Sq. Mil contains
27 878 400 sq feet

1. Experiment.

(.197)² = .038809 × 44.3 =
1.7192387 ÷ .008 =
218.9 ft lbs required to raise 73.48 sq inches to a temp of 103°F.

~~73.48 ÷~~ 218.90 ÷ 73.48 = 2.8 ft to one square inch.

Now 100 H.P. has 3300000 foot lbs.

~~2.8~~ 3300000 ÷ 2.8 =
1178571 square inches

1178571 ÷ 144 = 8184 this ÷ by 2 = 4092 square required,

---

2. Experiment

(.175)² = .030625 × 44.3 =
1.3566875 ÷ .008 = 169.8 ft lbs for a area of 73.48 sq inches, making 2.3 ft lbs to one square inch of surface to heat it to a temp of 99°F room being 86°F

100 H.P. has 3300000 ft lbs

3300000 ÷ 2.3 = 1447826 sq in
1447826 ÷ 144 = 10054 sq ft
10054 ÷ 2 = 5027 square feet required.

3d Experiment

$(130)^2 = .0169 \times 44.3 =$

$.74867 \div .008 = 93.5$ ft lbs
required to heat 73.48 sq inches
to a temp of 94°F
Room being 86°F or
1.2 ft for each square
inch surface

~~100 H.P. has 3300000 ft lbs~~
$3300000 \div 1.2 = 2750000$
$2750000 \div 144 = 19097$ sq ft
$19097 \div 2 = 9528.$ sq feet
required

115
115
575
115
115
13225
44
52900
52900
581900

!

158 / 581.900.000 (3682911
474
1079
948
1310
1264
460
316
1440
1422
180
158
220
158

158.

8
16
8
128

158
15
0

850
16
00
850
850
1360

850
15
4250
850
12750

850 / 1580.0 (1
850
3080

850 / 15800 (8.
850
7300
7380
6800
500

18 / 111 (6.
108.

6. hp.

33000 / 3682911 (111 1/2
33
38
33
52
33
19.

850
20
17000

14 / 3682911

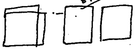
850
18
6800
850
153.00

66,

1/5,

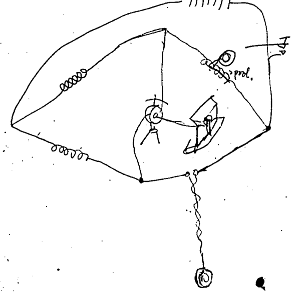
8.80

850
19
7650
850
16150



161.

18 to 1.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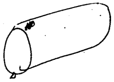

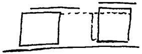

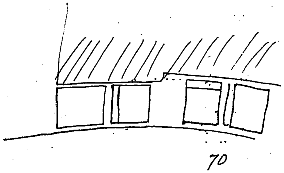
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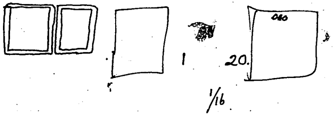
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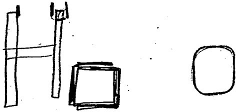
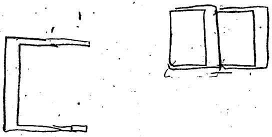
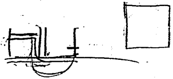
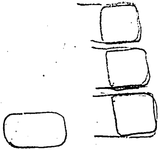
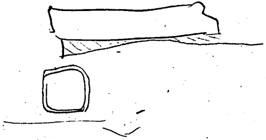
20.
080
1/16











Aug 5 1881

~~Temp of Room 95° F~~

Test of Paris dynamo

---

volts 95 barrels 4

Started 330 Rev at 1 PM

Stoped running at 1.15 " "

Temp of arm.

Started 1.55 Rev. 330

runed 9 minutes

Started 4.34

Ran 11 m.m. Temp about 125

~~Started again at 4.47~~ P.M

The dynamo ~~to~~ ran 20 minutes with four barrels on

~~Started again a 7.37~~

1/16 latter of the field magnet

Aug 7 188

~~Started 11.20 a.m.~~

without any Cur
the magnet
Residual magnetism
def on arm 52–49
S.B 301 — 302
Rev 3~~48~~

Mag 23 – 24
S.B, 252–255
Arm 244 –242
S.B, 252 –255
Rev 348

Mag 43–42
S.B 252–255
arm 285 –286
S.B 252 –255
Rev 348

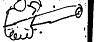
Mag 30 – 33
S.B. 139 –138
arm 202 – 199
S.B 139 – 138
Rev 348

Mag 38 – 35
S.B 139 – 139
arm 230 –234
S.B 139 — 138
Rev 348

Mag 40 –42
S.B. 139 – 138
arm 252 – 255
S.B. 139 – 138
Rev 34.8

Mag 37 – 43
S.B. 139 – 138
arm 285 –287
S.B. 139 – 138
Rev 348

Mag 43-49
SB 139-138
Arm 299-295
SB 139-138
Rev 347



Mag 53-47
SB 139-138
Arm 306-302
SB 139-138
Rev 347

Mag 57 60
SB 139-138
Arm 337-336
SB 139-138
Rev 348

Mag 58-63
SB 139-138
Arm 241-237
SB 91-95
Rev 347

Mag ~~91-95~~ 39-43
SB ~~39-43~~ 91 95
Arm 250-247
SB 91-95
Rev 348

Mag 46-44
SB 91-95
Arm 261-261
SB 91-95
Rev 347

Mag 50-48
SB 91-95
Arm 278-277
SB 91-95
Rev 347

Mag 51-53
SB 91-95
Arm 295-294
SB 91-95
Rev 350

Mag 51-53
SB 91-95
Arm 281-289
SB 91-95
Rev 347

Mag 56-55
SB 91-95
arw 303-302
SB 91-95
Rev 344

Mag 58-60
SB 91-95
Arw 318-316
SB 91-95
Rew 347

Mag 61-64
SB 91-95
Arew 322-322
SB 91 95
Rew 345

Mag 67-65
SB 91-95
arw 335-338
SB 91-95
Rev [redacted] 345

Mag 61-64
SB 91-95
arw 335-335
SB 91-95
Rew 346

Mag 53-49
SB 66-59
arw 239-241
SB 66 59
Rev 347

Mag 50-54
SB 66-59
arw 242-242
SB 66-59
Rev 343

Mag 57-58
SB 66-59
arw 256-258
SB 66-59
Rew 350

Mag 62-62
SB 66-59
arw 272-272
SB 66-59
Rew 349

Mag 67-68
SB 66-59
arw 276-279
SB 66-59
Rew 350

Mag 72-72
SB 66-59
arm 284-288
SB 66-59
Rev 349

Mag 75-81
SB 66-59
arm 299-294
SB 66-59
Rev 350

Mag 97-92
SB 66-59
arm 312-307
SB 66-59
Rev 349

Mag 108-106
SB 66-59
arm 320-322
SB 66 59
Rev 350

Mag 124-125
SB 66 59
arm 342-336
SB 66-59
Rev. 350

Mag 145-144
SB 66-59
arm 350-357
SB 66 59
Rev 349

Mag 168-169
SB 66 59
arm 189-183
SB 31-34
Rev 346

~~Mag 110-107~~
~~SB 34-31~~
~~arm 206-195~~
~~SB 34-31~~
~~Rev~~

~~Mag 127-133~~
~~SB 34-31~~
~~arm 205-215~~
~~SB 34-31~~
~~Rev~~

Mag 131-126
SB 34-31
Arm 213-200
SB 34-34
Rev 340

Mag 141-146
SB 34-31
Arm 207-222
SB 34-31
Rev 340

Mag 161-157
SB 34-31
Arm 212-212
SB 34-31
Rev 347

1.5) 2120 (141
15
62
60
0

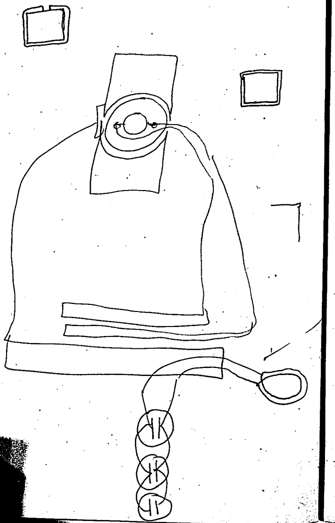
Aug 7 1881 @ Dynamo

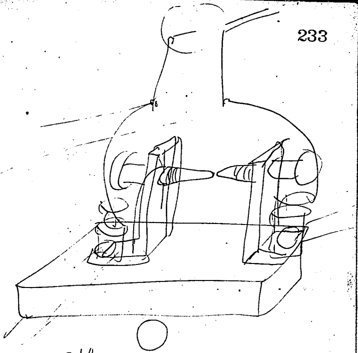
Started @ 3.28
EMF 45
Rev 148

EMF 65
Rev 200

~~1016~~

Running 330
E.M.F.





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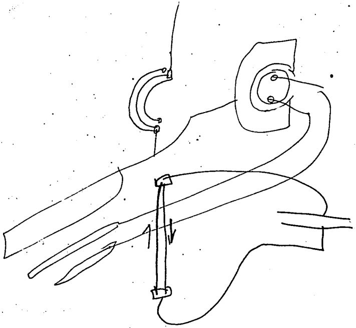
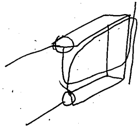
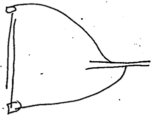
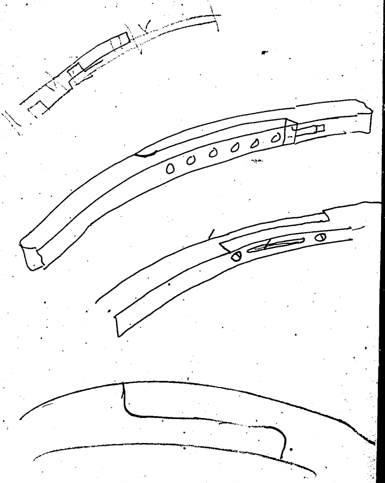
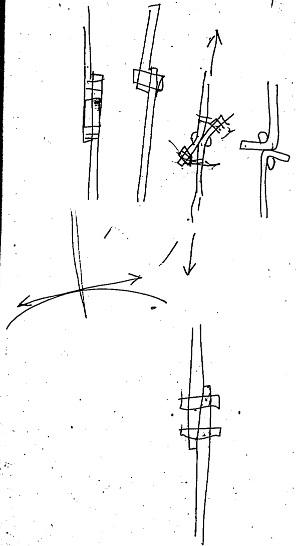










~~Started at~~ ~~P.M.~~ Started at 12 P.M.

Sunday Aug 8 18

Test of the "C" dynamo with a load of 3 barrels

Arm 78 volts
SB.
Mag 20-31
SB 32-32
Rev 340

Arm
SB
Mag
SB
Rev

Arm 119-117
SB 32-32 ~~79.54~~ 79.4 V.
Mag 30-31
SB 32-32 20.52
Dea 1
Rev 343

Arm 240-244
SB 57-68
Mag ~~169-168~~ 173-176
SB ~~175~~ 169-168
Dea 2
Rev 338

Arm 248-239
SB 57-68
Mag 65-74
SB 57-68
dia 3
Rev 334

Started

arm 247-256
SB 57-68
Mag 81-70
SB 57-68
Dia 4
Rev 341

arm 268-258
SB 57-68
mag 194-183
SB 57-68
dia 5
Rev 334

arm 271-262
SB 57-68
mag 90-100
SB 57-68.
Dia 6
Rev 335

arm. 268-276
SB 57-68
mag 108 98
SB. 57.68
Dia 7
Rev 333

arm 285279
SB. 57-68
mag 119-128
SB 5768
Dia 8
Rev 330

arm 286-293
SB 57-68
mag 140-132
SB 57 68
Dia 9
Rev 331

arm 303 297
SB 57-68
mag 149-156
SB 57-68
Dia 10
Rev 332

Stop at 1 am aug 8 1881
running 1 hour.

August 8th 1881 TAE

Experiments on the resistance of moving contacts especially in regard to Commutators and their brushes used on Dynamos -

with South Ann Mac shaft run by Gramme at varying sieeds brushes sideswise but not end on good pressure, (more than ordinary

Resistance commutator still, 055.
" ~~ke~~ shortckled, 043,
" 065
" Speed 670 Rev 068
" 812 " 072
915 " 073.
930. "

Brushes put slightly more Endon - speed.

(copy of Edisons chart)

Experiments to be tried tonight
Clean Commutator

1 Sims to make experiments with the string on the indicator - Field off brushes off.

2 Take diagrams with boiler pressure 90 ditto 70

3rd Run 20 minutes with brushes off - indicate by heat, no blower on (Field on)

4. Cool down armature by blower then put brushes on, one brush on block the other on insulation - run 2 minutes indicate - notice heat (open circuit)

5 Put on 3 barrels go to 103 volts then set commutators ahead block at a time in direction of rotation notice spark and drop in volts, use the mercury brushes.

6 Try new brushes (10) sheets without mercury

7 " " " with mercury

8 Try wire on other brush featwise

9 Set one brush on one side block ahead of the other brush on the same side set drop.

10 Measure resistance while running bet. 2 brushes on the same sides

---

(Ex 1) Started ~~10.15~~ 9.45

B.P.
348.

We took 5 Cards numbered from 1 to 5 ~~of~~ with field off Brushes off - 9.57 =

We now at 10.02. take Cards with field off ~~but brushes~~ on - one brush on insulation one on middle of block =

Now we put field on. 89 volts, Seperate Machine - Brushes on - no current from machine = Brushes on - Stopped 10 42 - no blower on - worked cards off at diff boiler pressure 90 down to 60

118.) 800 (6
708

118) 800 (7
826.

We Start the blower & take
Cards to see if there is any more
friction — 10 46 PM = — Stopped 10 53 —
taking 2 cards one with blower off
& 1 with blower on = 60

---

1 Barrell on 11 13 PM, - own field,
Hg Brushes - there no spark except very
very slight,

with one Bbl on 103.
It dropped to 94 — when ~~B~~ another
Barrell put on — 2 bbls on now —
Shutdown 27 minute to 12

4 bbls 12.16 AM. Started
12.42 " Shut Down

armature not very hot
would run that way all
day — Thought we saw at spark

shut down started again
1 06 am. to see if it would
cross again, 4 barrells on,

110 B.P.

Aug 11 1881 -

Tests with Indicator and weighing Coal & water on Babcock & Wilcox Boiler, Lump anthracite - Croton water =

First test simple friction Engine. no field =

Evaporation Commenced, ^{BP}120 - 10 51½ PM. — Engine started at. 1103 PM with 3 bbls on — on test = Volts. ^{103}= Besides the 3 bbls there is 9 other lamps on.

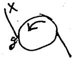
103 Volts on armature

average heat 129 deg in barrels -

Had to increase speed of blower after 2 hours run after 4 hours had to increase it again = bobbin very hot. over

took speed of the blower —
(Large size =) 1940 Rev per minute.
It will require the boring out
of $\frac{1}{32}$ and air equal to a
speed of the big blower 2500
per minute to keep cool —

Mercury wears nearly off
Commutator after 4 hours run
and brushes especially X

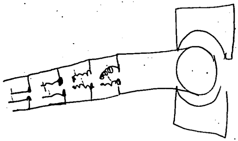


Sparks somewhat freely as it
catches stuff at g. — Mercury 430 AM.
worn off sparks rather badly .335

Shut down at 5.10 am —
Stopped Evaporating water at 5.17 am
Over

Mercury wore off about 3 am Sparked badly after that & spotted up commutator pretty well = Armature when stopped not extra hot though it wouldnt do to let it get any hotter = The joints or contacts were quite hot and the bolts that goes through plate very hot = temperature of the contacts at 6 am is 147 =

There was 6 ohms outside of field -



Square of the diameters x by .7854 = area.

---

12 x 12 = 144 x .7854 = 113.098 area

Take the average pressure from the indicator card equal (for example) 30 lbs.

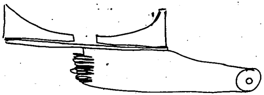
Diam of Cyl = 12"
length of stroke 12"
Rev. per min = 350

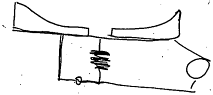
113.098
30

3392.940 = lbs pressure on cyl.
700 feet travel

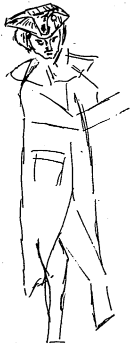
33000)2375~~058~~000 = ft lbs

70 H.P.

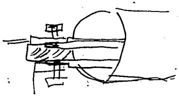


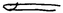


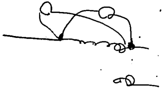
F. J.

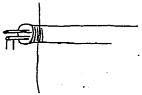


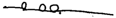
$\frac{15}{400}$ $\frac{2}{20}$ $\frac{3}{80}$ $\frac{1}{26}$

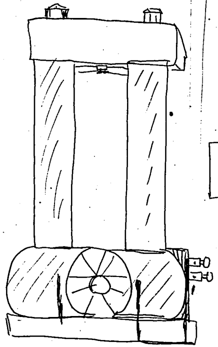


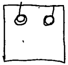


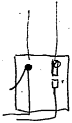


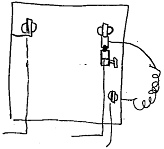












2 (65
.32

110
110
11000
100
12100
44.3
36300
8400
44
424

~~33.00~~) 536030.0 (1
33
20

32) 53603000 (167509.0
2.16
192
240
224
163
160
300
298
20

~~33.00~~) 1675 (51.
165
25

51HP

2(1.65

32

65 2(1.3
4(.65
.13

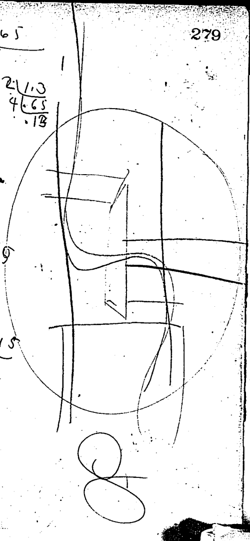
13

800)1250(.15
800
4500
400

2(65
1 29

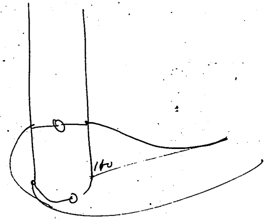
4(.65
16

800)1250(15
800
4500
4000

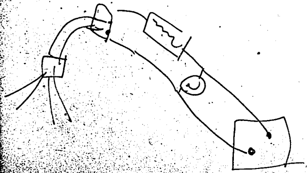


1/8 wire
22.18' long
.012

5)(.65
.13



~1991



24 2
16.8

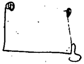
~~1000~~)100
.1

100)100 (.1

200)100 (

3)(2.6
0.8

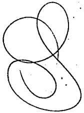
20 150)1000 (6
900



1
(2.6
.86

S

I hope I'll meet you soon again



9
20)90 (.45
80
10

336.